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REMARKS ON A FATAL RESULT FROM THE
USE OF THE ELASTIC BANDAGE IN
THE TREATMENT OF A POPLI-
TEAL ANEURISM.

A PAPER READ BEFORE THE NEW YORK SURGICAL SOCIETY,
FEBRUARY 10, 1880

BY

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REMARKS ON A FATAL RESULT FROM THE USE
OF THE ELASTIC BANDAGE IN THE TREAT-
MENT OF A POPLITEAL ANEURISM.*

By ROBERT F. WEIR, M. D.

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Since the introduction of the elastic bandage in the treatment of external aneurism by Reid in 1875, some twenty-seven† cases have up to the present time been reported in the journals without any untoward accident having occurred, though reasoning from analogy, two risks seem to be connected with this mode of treatment. These risks are, first, that the soft recent clot might give rise to inflammatory action in the sac, and second, that gangrene of the distal portion of the limb might result, either immediately or at a later period, from the severe and prolonged ischæmia. No case of inflammation or suppuration of the sac has in reality occurred, and furthermore since it has been proven that such a complication is generally due to a traumatism applied either directly to the aneurism itself or to the artery near to it, it need no longer to be feared by the surgeon.

In respect, however to the second risk, to wit gangrene, I must refer, with your indulgence, to an article published in the *American Journal of Medical Sciences* for April, 1879, in which the clinical experience on the subject of the protracted arrest of the circulation of a limb is given by me as far as then could be collected. This experience was, to re-

* Reprinted from the "Archives of Medicine," Vol. iii, No. 2, April, 1880.

† Eighteen of which were successful, and nine failures.

capitulate briefly, as follows: that by the use of the tourniquet alone the blood circuit in an artery had been controlled, for instance, by Murray for four hours for an aortic aneurism; by Wheelhouse, for five hours by the complete compression of the abdominal aorta for an aneurism of the external iliac; by Durham, by proximal pressure on the aorta for ten and a half consecutive hours; by Bryant also by distal pressure on the same arterial trunk for twelve and a half hours (in both of these latter cases for aortic aneurisms); by Mapother, by complete compression of the femoral artery for nine and a half hours for a popliteal aneurism, and by Erskine Mason by the continued compression of the femoral artery for eighteen hours for a varicose aneurism. In all these instances no damage to the integrity of the limbs took place, though coldness, lividity and numbness existed in nearly all of them for sometime after the removal of the pressure, and in Durham's case, which was a successful one, the coldness and patches of purplish discoloration persisted for two days. Other cases confirming the tolerance of the limbs to the effects of instrumental pressure could, if desirable, be cited where the circulation had been even longer interrupted. Such cases are instructive though not as pertinent or conclusive as are the results of compression by means of the elastic bandage of Esmarch. In this particular we of necessity possess only a paucity of facts. Jeremoff and Cohnheim have shown that in the lower animals such a compression of a limb could be borne innocuously from six to eight hours, and on the human subject the rubber bandage and tubing have been resorted to by Heath,* in one instance for four and a half consecutive hours, and by Barwell,† with the elastic bandage alone for five hours without

* *Lancet*, Dec. 1, 1877.

† *Lancet*, Jan. 26, 1876.

detriment to the limb. The most severe test, however, is the case* where for an obstinate hemorrhage in the hand the elastic bandage and tubing were applied to the arm for fourteen hours continuously, causing, on their removal, only intense swelling and redness of the previously compressed parts, which strongly simulated phlegmonous erysipelas. These symptoms, however, subsided in a few days though paralysis of the arm continued for several weeks.

My own experience in the treatment of external aneurisms by the elastic bandage is limited to three cases, two of which were successful, and the last one, which is the subject of the present remarks, with a fatal issue. In the first case, a femoral aneurism in which several ineffectual trials of Esmarch bandage without ether had been made, prior to the patient coming under my charge, success was achieved by the application of the rubber bandage below and above the tumor, with the coincident employment of the rubber tubing about the thigh. This compression was kept up under an anæsthetic for ninety-three minutes, when the bandage and tubing were removed, and a Signoroni's tourniquet applied for three hours and twenty-seven minutes longer; in other words, the arterial arrest lasted in all five hours. A shot-bag weighing seven pounds was then secured over the common femoral for fifteen hours longer, when the cure was completed.

The second case,† also one of femoral aneurism was particularly interesting, as an attempt was made to carry out in part the suggestions of Mr. Fergusson, of the Cheltenham Hospital, England. The elastic bandage was dispensed with in the first two trials made one day apart, of ninety and of sixty minutes duration, respectively, and

* *Wien. Med. Wochenschr.*, June 4, 1876.

† *N. Y. Jour. Med.*, May, 1879.

the circulation of the limb controlled by simply encircling it tightly with two or three turns of rubber tubing. Although the tourniquet was, on the withdrawal of the tubing, applied two and three-quarter hours longer, yet a failure resulted from both trials. A third and successful essay was then made in the same manner as in the first case, and the bandage and tubing kept on two and a half hours, when the ether was left off, a tourniquet tightly applied for two and a half hours more, then a Nicaise tourniquet (a broad elastic bandage going around the limb two or three times) for five hours longer, making thus a total arrest of the blood current through the limb for ten hours without any injury to the parts beyond, except a slight numbness which passed off in the course of the next twenty-four hours. The man went out of the hospital a few days afterward and resumed his work. I may add here, as bearing on the point recently raised by Mr. Puzey, in the *Lancet* of October 18, 1879, as to the permanency of a cure of aneurism by the elastic bandage, that this last patient has within the past week returned to the hospital for the treatment of an aortic aneurism and the remains of his cured femoral aneurism, the size of a large bean, can be felt with the artery pulsating down close to it.

The third and last case, the fatal one, is in detail, as follows:

Popliteal Aneurism. Esmarch's bandage for seven hours and twenty minutes. Collapse. Fatty Heart. Death.

Matthew Miner, a colored man of 38 years of age, of phthisical habit though in good condition, entered the New York Hospital, January 15, 1880, with a large popliteal aneurism of the right leg, which had existed about four months. He attributed the enlargement to an injury incurred by his foot slipping while he was lifting a heavy box. One week after this strain he felt a sharp pain in the right popliteal space, and after three weeks of neuralgic twinges in the limb, he noticed a pulsating swelling

in the ham. The tumor was found on his admission to the hospital to be somewhat larger than the closed fist, filling up the popliteal space, pulsating freely and expansively, and with a loud sharp bruit most noticeable at its upper part. The arteries in the groin and at the wrist seemed normal. At 3.45, P. M., the same day Esmarch's elastic bandage was applied, not very snugly, up to the tumor. The patient was then stood erect, and a second elastic bandage carried around the limb above the aneurism to the middle of the thigh, where the rubber tubing was tightly secured. The tubing was left on until 6.20 P. M., *i.e.*, two hours and thirty-five minutes, when it was removed, but not the bandage. A Signoroni's tourniquet was now applied, and retained with the bandage until 8.10 P. M., one hour and fifty minutes longer. This plan was adopted, as it had been noticed in this case as in my first case that the elastic bandage by itself did not control absolutely the current through the aneurism, and also that in my second case Nicaise's tourniquet answered so happily. Moreover, we thought by thus keeping on the bandage, that such firm compression by the tourniquet would not be demanded. The total compression was four hours and twenty-five minutes in duration, with the result of producing a consolidation of the aneurism. The patient was a man of strong will, and declined to take ether, and only received during the treatment a single hypodermic injection of \mathbb{M} x of Magendie's solution of morphia. The next day it was found that the pulsation had returned, but the leg was of natural temperature, though somewhat more swollen from the knee to the ankle.

On the 18th inst. the elastic bandage and tubing were applied as before, and retained from 5.20 P. M. to 8.10 P. M. (*i.e.*, for two hours and fifty minutes) when the rubber tubing was removed, and the bandage alone continued, through an error in my directions, an hour longer than was intended, on the limb, until 12.10 A. M., when the bandage was taken off and a Signoroni's tourniquet applied for half an hour longer at the groin. No bruit or pulsation was then to be detected in the aneurism, and the whole leg was cold and insensitive. The time occupied by the compression was in all seven hours and twenty minutes, during six hours and fifty minutes of which time the elastic bandage had been on. The patient had as before borne the pressure so well that only one hypodermic of morphine, gr. $\frac{1}{4}$, had been given. No ether was used, though ordered if the pain should be severe. His general condition when left for the night, as far as noticed, was good. As

a precautionary measure a seven pound bag of shot was laid over the artery at Poupart's ligament. The next morning, January 19th, when seen at nine o'clock by the house surgeon, the patient stated that he felt all right, only a little weak, but on trying the pulse at the wrist, it was found to be nearly absent, and in the femoral artery it was very weak and irregular. Temp. 101.2° , P. 78. Aside from the pulse, there were at that time no marked evidences of shock. The right leg from just below the knee to the toes was cold, and in the plantar surface of the foot were irregular mottled patches, but not more so than had been observed in my first case. No pulsation was to be detected in the aneurism or tibials, though in the superficial femoral above the aneurism it could be recognized. The patient was also able to move the limb. The whole leg and thigh were immediately enveloped in cotton, and hot air directed under the bedclothes, and whiskey administered, $\frac{3}{4}$ ss., every half hour by the mouth. At two o'clock in the afternoon the toes and sole of the foot and the upper and posterior part of the leg had become warm, and the area of coldness and duskiness now extended only from the root of the toes dorsally to half way up the leg anteriorly, and embraced nearly the full width of the limb. The patient's general condition had not changed for the better. Pulse at the wrist entirely absent; face bathed in perspiration; T. 99° ; P. 58; no anxiety of countenance, nor any mental disturbance. The patient said again he felt all right, with the exception of a slight nausea and sinking sensations.

Hypodermic injections of ether and whiskey were joined to the external exhibition of stimulants, but the patient never rallied, and at 4 A. M., January 20th, a little more than twenty-seven hours after the cessation of the compression, he died.

The autopsy twelve hours later revealed no evidence of change in the tissues of thigh, leg or foot of the affected side, except that the epidermis of the great and two adjacent toes near the nails could be easily detached, and looked as if this had resulted from a burn from the hot air apparatus. Slight serous infiltration and minute capillary hemorrhages were visible, more particularly in the deeper parts of the limb. The right leg measured two and a-half inches larger at the calf than the left, and on the skin above and below the aneurism could be seen a zone of deeper color than elsewhere, and apparently marking the site of the rubber bandages.

The artery and veins from the aorta to the foot were removed and carefully inspected. The veins were normal, and filled with

recently clotted blood. The femoral artery above the aneurism was empty of clot, and above the profunda the coats of the artery were normal; below this point to the aneurism, however, the artery was rough and thickened. Nowhere was there any obvious deposit of atheroma except one small patch in the common iliac. The artery below the tumor was filled to some distance below the bifurcation of the popliteal with a small amount of soft recent clot. The aneurism itself, which sprang from the anterior wall of the artery through an oval opening one and a quarter inches long, was twelve inches in circumference, and was filled with a well-formed recent clot. The anterior crural nerve at the point of pressure of the rubber tubing and tourniquet appeared normal.

Further examination showed advanced fibrous phthisis in both lungs, an atheromatous aorta, and microscopically a distinctly fatty degeneration of the muscular fibres of the heart, more particularly observed in the right than in the left ventricle. The other organs, brain, liver and spleen were normal. The kidneys were intensely congested, but otherwise normal.

So far as is known, this is the first fatal case resulting from the employment of Esmarch's elastic bandage in the treatment of aneurism. A case that was published by Mr. Bryant, of Guy's Hospital, London (*Med. Times and Gaz.*, July 27, 1878), has been quoted as one of gangrene due to this method, but an examination of the report shows that there had been two unsuccessful trials of the elastic bandage for a popliteal aneurism, March 12th and 15th, for two and a half and three hours respectively, and that twelve days after the last trial the artery was ligated in the usual locality. The next day signs of gangrene supervened, and extended from the toes to the ankle. On the 28th day after the ligation the leg was amputated, and it was then found that no vessels required to be tied. The patient recovered.

This case may therefore be set aside as not bearing on the point under consideration at present.

Cases of gangrene from other modes of compression are also exceedingly rare, and in a recent thesis on this subject

by Gancel,* but four cases were collected where the accident had taken place. In all these cases, save one, digital compression had been resorted to, and the examination of the limb obtained, either by reason of death or amputation, showed obliteration of the popliteal at its bifurcation by a clot. This condition associated with an atheromatous and hence undilatable and collateral circulation, Gancel believes to be present in every case of gangrene.

Although the post-mortem examination disclosed no positive signs of gangrene, and hence the cause of death may be assigned to the shock of the prolonged general compression of the limb upon the fatty heart, without the shielding effect of an anæsthetic, yet I cannot but feel that in the desire to speedily cure an aneurism, an undue risk would be run by a repetition of the treatment carried out in this case. Hereafter I should be inclined to adhere to the plan I had at first laid down in the paper alluded to above, and which the experience of my second case led me to depart from. This plan of treatment was to apply the bandage and tubing in such manner as to leave the aneurism exposed for observation, etc., and to keep up the compression for two hours, when the bandage and tubing are to be removed, and a Signoroni's tourniquet resorted to for a period of two hours more, when the tumor is to be examined, at the same time cautiously letting up the tourniquet. If pulsation is still felt, the compression of the tourniquet is to be resumed either in the same place or, preferably, in a new spot. In the event of a change in the site of pressure, an assistant is to carefully control the arterial current while the change of the instrument is being effected. The further continuance of a tourniquet for a period of two hours would, I think, be permissible, though it is most advisable to test the con-

* E. Gancel. Gangrène du pied et de la jambe à la suite du traitement des anévrysmes par la compression indirecte, 1879.

dition of the aneurism every half hour during the time. After the consolidation of the aneurism is effected, it is desirable to further control, to a certain extent, the circulation for several hours by the application of a shot-bag of a weight of five to seven pounds. Such a mode of procedure would, I think, be a safe one.



